

Operating Instructions

SINGLE SBC – Controller



SBC_EN_15_06

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1 Configuration and operation of the controller

1.1 Operating elements



-button (P)

Button P gives access to the parameters of each level.
For accessing the individual processing levels:

working level: push the P key

parameter level: push P and ENTER keys simultaneously

configuration level: keep P and ENTER keys depressed simultaneously for about four seconds



- button (Enter)

All changes must be confirmed with this button. (set-point and parameter)



- button (+)

The (+) button is used to increase the set-point and parameter values.
Each change must be confirmed by pressing the ↴ button.



- button (Off)

All systems are "off". If power is still present the start screen is displayed.



- button (On)

The system is "working", the pump and controller are "active".



- button (-)

The (-) button is used to decrease the set-point and parameter values.
Each change must be confirmed by pressing the ↴ button.



1.2 Control panel

Display PROCESS:

Display of pre-run temperature's actual-value.

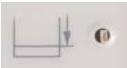
Display of parameter designation, when operating at working-, parameter- and configuration-level.

Display SET

Display of the current or programmed set-values.

Display of numerical values or parameter values when at working-, parameter- and configuration-level.

1.3 Alarm panel and display information

Symbol	Designation	LED glows because:	Rectification / explanation
	Minimum level	Minimum level not made	Water: with manual filling: replenish with heat transfer medium with automatic filling: open cooling water supply, wait till filled Oil: fill or replenish with oil
	Limit-comparator	Limit-comparator outside band-spread, limiting value exceeded	Not up to temperature, or outside band-spread (limit) Band-spread too narrow or limiting value made. Turn OFF at working level, parameter AL, or set band-spread.
	Pre-run temperature	Pre-run temperature up to limiting value Heating switches OFF	Check set limiting value; insufficient heat dissipation by consumer. Subsequent to cooling by 5 K, heating comes ON again
	Heating	Heating on	-
	Cooling	Cooling on	-
	Operating mode display	Temperature control unit (TCU) activated	LED flashes when the TCU is - switched off via the pump after-run control - too full in oil configuration



2 Parameter description

2.1 Working level

Pushing the P-button, will access the working level. Individual parameters are accessed by pushing the button marked P. The PROCESS-display shows the parameter. The SET-display shows the parameter value.

The first display shown after pressing button P is the status display. If an error has occurred, this will be displayed:

ALAR FLO = flow error

ALAR PUMP = motor contactor triggered

ALAR FILL = filling time exceeded

ALAR niv.H = max level. exceeded (only with oil units)

Parameter description:

Parameter	Set-values range		Signifying
AL	OFF	OFF	Alarm outputs selected.
	OFF, -99	100	Alarm output programmed as signal contact ① max. OFF-ON. The setting-value corresponds to the alarm's response value, relative to the set point-value.
	MR*-start	MR*-end	Alarm output programmed as limiting contact ② max OFF-ON. The set point-value corresponds to the absolute response-value of the alarm.
	OFF, 0	100	Alarm output programmed as limit comparator ③ OFF-ON-OFF. The set point-value corresponds to the set point's tolerance-value.
	OFF, -99	100	Alarm output, programmed as signal contact ④ max. ON-OFF. The setting-value corresponds to the alarm's response value, relative to the set point-value.
	MR-start	MR-end	Alarm output programmed as limiting contact ⑤ max ON-OFF. The set point-value corresponds to the absolute response-value of the alarm.
	OFF, 0	100	Alarm output programmed as limit comparator ⑥ ON-OFF-ON. The set point-value corresponds to the set point's tolerance-value.
	OFF, 0	100	Alarm output programmed as limit comparator ⑦ ON-OFF-ON (with stand-by response). The set point-value corresponds to the set point's tolerance-value. No alarm during initial start-up, until the input range is made.
SP2	MR-start	Set-value limiting	Programmed value corresponds to 2 nd set-value. Change-over to 2 nd set-value takes place via parameter SET = SP.2 at working level. Also refer to configuration level.
AP.I	MR-start	MR-end	Programmed value corresponds to the response temperature of the inlet-temperature limitation. If up to end of measuring range is programmed, the value end of measuring range +5°C is displayed.
Ati	OFF=0	40	Aquatimer: set point-value corresponds to the max. permissible filling cycles after 1 hour of operation.
Cti	OFF, 10	900	Change time; evacuation / vacuum time on units with automatic mold draining. Set point-value corresponds to the compressed-air assisted evacuation time or else the vacuum-time in seconds.
LS	OFF	on	Turning the leak-stop mode ON and OFF. ON means leak-stop mode turned ON. OFF means leak-stop mode turned OFF.
rEMo	OFF	on	Turning the remote function ON and OFF at units with interface.

*MR = metering range



Parameter	Set-values range		Signifying
niv	Hand	Auto	Hand = manual filling of the unit Auto = automatic filling of the unit Auto not possible for heat transfer units with oil
CHG	no.Ch	Chg	no.Ch mould draining not active Chg mould draining active. Only for units with mould draining! Change-over must be set free in the configuration level!
dir	indi	dir	indi = Cooling via heat exchanger dir = direct Cooling Direct cooling only possible at units with water Change-over must be set free in the configuration level!
bLEd	OFF, 1	240	Vent after switching on Setting in seconds
C.OFF	OFF	Co.OF	OFF means, that the unit is turned OFF directly with the „0“ key. Co.OF means, that when pushing the "0" key, the unit is cooled down first, before it is turned OFF. (Pump lag control)
SEt	SP.1	SP.2	Change-over SP.1 = internal set-value active SP.2 = second set-value active
Adr	1	255	Input of unit addressing. If several units are operated by the same interface, different addresses must be chosen.
AL2			Compare with parameter AL
t.out			Shows the pre-run temperature in the SET-display

2.2 Parameter level

Pushing the buttons P and ↘ will access the parameter level. Individual parameters are accessed by pushing the P-button. The PROCESS-display shows the parameter. The SET-display shows the parameter value.

Parameter	Set-values range		Signifying
Y%			Indication of the actual limitation of regulation ratio
hL%	0	100	Limitation of regulation ratio for heating in % ¹
cL%	0	100	Limitation of regulation ratio for cooling in % ¹
hP	OFF, 0.1	99.9	XP-Heating in %, the control system's proportional range
hd	OFF, 1	200	TV-Heating in sec., derivative action time of the control system
h I	OFF, 1	999	TN-Heating in sec., integral action (reset) time of control system
cP	OFF, 0.1	99.9	XP-Cooling in %, the control system's proportional range
cd	OFF, 1	200	TV-Cooling in sec., derivative action time of the control system
c I	OFF, 1	999	TN-Cooling in sec., integral action (reset) time of control system
db	OFF, 0.1	10.0	Switching hysteresis between heating and cooling. This parameter is used for increasing the set-value (switching point) for cooling by the value entered. That way, possibly too frequently occurring switching changes between heating- and cooling modes can be prevented. Simultaneous switching of heating and cooling can be ruled out generally. Settings are in °C.
hC	1	240	Heating switch-cycle time in sec. ²
cC	1	240	Cooling switch-cycle time in sec. ²
SP.Hi	SP.Lo	MR-end	Upper set point limitation in °C. Here the final value for the set point setting range can be selected.
SP.Lo	MR-start	SP.Hi	Lower set point limit in °C. The start value of the set point adjustment range can be preselected here.
SCL	OFF, 35	90	System Closed = system shut-off on units employable at > 90°C, the water system is shut-off to atmosphere. Water: temperature selection for system shut-off in °C Oil: evacuation by vacuum only possible below the set SCL-value (CHANGE)
C-F	C	0,1 C	Selection °C, °F or 1/10 °C
OPt	OFF	on	Turning self-optimization ON and OFF. ON = Self-optimization started. The controller determines the optimum control parameters by closed-loop control. Also refer to Chapter 2.4 „Setting the closed-loop control parameters“.
SP/	OFF_0,1	99,9	Set point ramp rising
SP\	OFF_0,1	99,9	Set point ramp decreasing
HY.Hi	0,5	10,0	Cooling ON hysteresis
HY.Lo	0,5	10,0	Cooling OFF hysteresis
h			Operating hours

¹ Limitation of the regulation ratio is only required with an excessively overdimensioned energy supply for the control system, or for turning-OFF the corresponding actuating output port (setting 0 %).

It should be inoperative under normal circumstances (setting 100 %). Limitation of the regulation ratio becomes active, when the regulation ratio calculated by the controller is greater than the max. permissible (limited) regulation ratio. **Please note:** Limitation of regulation ratio is ineffective during the self-optimization phase.

² The control element's maximum switching frequency is determined with the assistance of the switch-cycle time. This is the period during which the controller carries out one **ON** and one **OFF** switching action.

We recommend the following settings:

- Relay-setting outputs with downstream installed contactors: switching cycle > 10 s
- Bi-stable voltage output ports for actuating Solid State Relays (SSR): Switch-cycle time 1 ... 10 s
- Continuous actuator output: Switch-cycle time 1 s

2.3 Configuration level

Pushing the buttons P and ↘ for about four seconds will access the parameter level. Individual parameters are accessed by pushing the P-button. The PROCESS-display shows the parameter. The SET-display shows the parameter value.

Parameter	Set-values range		Signifying
LOC	OFF	ALL	<p>Keyboard interlock</p> <ul style="list-style-type: none"> • OFF = parameter values can be changed. • PC = Parameter level and configuration level barred. Parameters can only be viewed. • SP.t = set point-value can be altered. All function keys are enabled, if not barred by the configuration level. • o.SP = all keys, except for „0“ and „!“ are barred; only the set point-value can be altered • ALL = complete keyboard interlocking; it is only possible to switch ON and OFF; no set point-value alteration possible! <p>Please note! When changing the LOC-parameters, ENTER must be kept depressed, until the moving illumination has passed-through for the second time (about 5 s)!</p>
ECO	OFF	on	Configuration of external contact OFF: Pin 10 = inlet flow monitor on: Pin 10 = switch-over setpoint value 1 / setpoint value 2
niv	on	LOC	Enabling the filling modes „AUTOMATIC/MANUAL“ <ul style="list-style-type: none"> • on = change-over facility of the key marked LEVEL is enabled • LOC = change-over facility of the key marked LEVEL is blocked.
c60	OFF, 10	100	Enabling or locking the software-key of the pump-lag control <ul style="list-style-type: none"> • OFF = „OFF“-key blocked • 10...100 °C = adjustable switch-OFF temp.
C.OIL	AqUA	OIL	AQUA = water unit OIL = oil unit
cdi	OFF	on	Interlocking of the “direct cooling” key (unit must be equipped with hydraulics) <ul style="list-style-type: none"> • on = change-over to direct cooling is enabled • OFF = no direct cooling allowed
C.AL	OFF	7	Configuration of the alarm output port <ul style="list-style-type: none"> • OFF = Alarm has been turned OFF • 1 = Signal contact OFF-ON • 2 = Limiting contact OFF-ON • 3 = Limit comparator OFF-ON-OFF • 4 = Signal contact ON-OFF • 5 = Limiting contact ON-OFF • 6 = Limit comparator ON-OFF-ON • 7 = Limit comp. with stand-by response <p>In the ON-position, output port is open. In OFF-position, output-port is closed.</p>
C.SA	oP	cL	Configuration group interrupt <ul style="list-style-type: none"> • oP = n/c contact • cL = n/o contact



Parameter	Set-values range		Signifying
ChL	dd	Ldd	<p>Change-logic configuration The change sequence will have to be preselected as a function of the unit's hydraulic and electrical specifications.</p> <ul style="list-style-type: none"> • dd = Mold evacuation by compressed air • LS = Mold evacuation by vacuum suction (leak stop-function) • Ldd = at present as per dd • 8-9 = Mold evacuation with compressed air, when units with "System shut-off in cooling water return" are employed, e.g. STW 1-HTK and STW 150/1-HK + HN
E.LS	on	LOC	<p>Interlocking of "LS" leak-stop parameter at working level (when hydraulic prerequisite is missing).</p> <ul style="list-style-type: none"> • ON = Changing of the "LS"-parameter enabled at working level • LOC = Changing of the „LS“-parameter blocked at working-level
ASt	5 min	120	<p>Aquatimer-Start-time (min) Aquatimer (filling-impulse-counter) becomes active following the time set in the "ASt". Previously not monitored random filling cycles. Renewed start of the "AST" time, following the On/Off.</p>
FiLL	OFF; 1	99	<p>Monitoring of filling time Setting in minutes</p>
EMO	OFF	on	<p>Restart lockout after power reset off = Restart lockout not active on = Restart lockout active</p> <p>Following a power reset, the control system stays turned OFF, to start with. Display "Info". "EMO" message – flashing. LED in the "O"-key flashes. All other displays – except for Power LED – are OFF. The control system can be turned ON with the following sequence. ENTER the "EMO"-message with the "O"-key. LED in "O"-key is now permanently alight. The "EMO"-message must then be deleted. Now the control system can be turned ON with the "I"-key.</p>
OF1	OFF, -100	100	Temperature correction of the internal temperature probe in °C
OF4	OFF, -100	100	Temperature correction of the probe for inlet temperature in °C
OF6	OFF, 1	100	Duty cycle offset info for system output cooling. Use of the parameter: To equalize unsteadiness of a cooling valve, an offset (OFF-Set) can be entered here in %.
P.Fi	OFF, 0,1	60	Filter for stabilization of the actual-value display
Pro	OFF	St	<p>Setting of the various interface protocols</p> <ul style="list-style-type: none"> • OFF = interface mode turned OFF. Parameter Adr, b and For are without any significance • A = Arburg-protocol active • A = Krauss Maffei-protocol active • b = Dr. Boy-protocol active • E = Engel-protocol active • CΠ = Krauss Maffei-protocol active • St = SINGLE Standard-protocol active • Pb = Profibus active only at SBC with Profibus interface



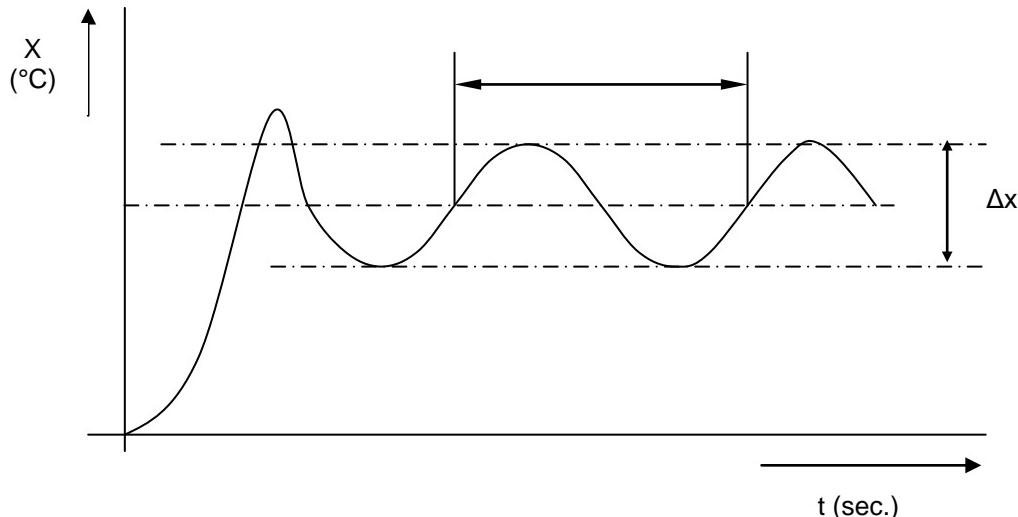
Parameter	Set-values range		Signifying				
b	OFF, 0.3	19.2	<p>This is where the transmission speed – baud rate – of the interface is being programmed.</p> <p>Possible settings are as follows:</p> <ul style="list-style-type: none"> • OFF = no baud rate set • 0.3 = 0.3 kBaud • 0.6 = 0.6 kBaud • 1.2 = 1.2 kBaud • 2.4 = 2.4 kBaud • 4.8 = 4.8 kBaud • 9.6 = 9.6 kBaud • 19.2 = 19.2 kBaud 				
For	7E1	8n2	<p>Here the Interface's data format is being programmed.</p> <p>The data-format is comprised of: Data-bits, parity bit, stop bit.</p> <p>Possible settings are: 7E1, 7o1, 7E2, 7o2, 7n2, 8E1, 8o1, 8n1, 8n2</p>				
dn1	0	999	Here the first 3 digits of the equipment No. are programmed.				
dn2	0	999	Here the last 3 digits of the equipment No. are programmed.				
C.OFF	c.OFF	c.Gr	<p>Programming c.OFF After switch-off via the pump run-on control, 100% cooling is effective until cooling temperature is reached.</p> <p>Programming c.Gr After switch-off via the pump run-on control, the default cooling gradient is effective until the cooling temperature is reached.</p>				
C.A2			Compare with parameter C.AL				
ConF	3P	2PC	<p>Control response configuration</p> <table style="margin-left: 40px;"> <tr> <td>3P</td> <td>3-point controller heating/cooling</td> </tr> <tr> <td>2PC</td> <td>2-point controller cooling</td> </tr> </table>	3P	3-point controller heating/cooling	2PC	2-point controller cooling
3P	3-point controller heating/cooling						
2PC	2-point controller cooling						
PSI			-				

2.4 Setting the control parameter

2.4.1 Determining the parameters with closed control circuit

If the time response of the controlled system is unknown and if the control circuit can be made unstable for short periods, then the controller is operated with $x_p = 0$ (on-off, without time response).

The control parameters are calculated from the resulting waveform as follows:



T = oscillation period

Δx = oscillation amplitude of the actual value

Delay time:

$$T_u = \frac{1}{4} * T$$

Lead time:

$$T_v = \frac{4}{10} * T_u$$

Reset time:

$$T_n = 5 * T_v$$

Proportional range:

$$x_p = \frac{\Delta x * 2}{\text{Meßbereichsumfang}} * 100\%$$

Span SC:

430 K

We recommend setting the proportional range "cooling" to two times the value.

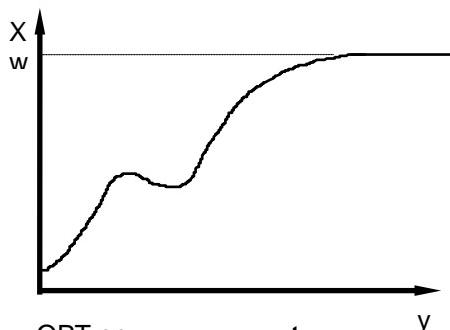
2.4.2 Self-optimisation

The optimisation algorithm with closed control circuit ascertains the characteristics of the controlled system and calculates the feedback parameters (X_p , T_v , T_n) and the switching cycle time ($C = 0.3 \times T_v$) for a PD/I controller valid over a wide range.

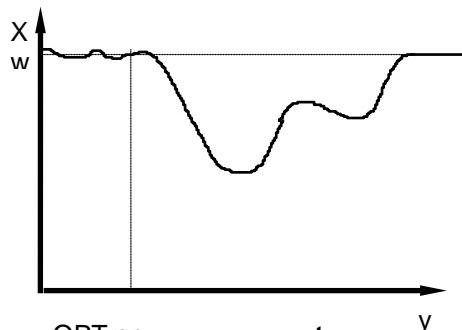
If the controller is operated as a "heating-off-cooling" controller then the parameter values determined under "heating" are used for "cooling".

The optimisation is carried out during start-up shortly before the setpoint. This must be at least 5 % of the span. During the optimisation to a setpoint that has already been reached, the temperature is reduced by approx. 5% of the span in order to accurately determine the controlled system gain.

The optimisation algorithm can be triggered at any time by selecting "Self-optimisation = ON" and confirming with the "Enter" button. During the optimisation process "Opt. Activ" is shown in the display. With 3-point controllers (heating-off-cooling) the temperature reduction is accelerated via short-term activation of the cooling. After the feedback parameters have been calculated the controller maintains the actual value at the current setpoint.



**Optimisation during heating
of the controlled system**



**Optimisation to setpoint
already "attained"**

By selecting "Self-optimisation = OFF" and pressing the "Enter" button, the optimisation process can be interrupted.



3 Connecting diagram

Interface optional!		St3 PIN	
0/20 mA TTY	Profibus DP		
	GND	85	
TTY 20 mA-	RxTxP	86	
	RxTxN	87	
TTY 20 mA+	Vp +5V	88	

		St1 PIN	
draining		17	18
system closing		15	16
pump		13	14
heating		11	12
motor protection		9	10
level min.		7	8
Pt 100 control		5	6
		3	4
0 V		1	2
		24 V	

		St2 PIN	
group alarm		3	normally open contact
		2	opener
		1	two-way contact

4 Technical data

Power supply	24V DC 0,1A
Actual value monitoring	Pt 100 2-two-wire lead Resolution 0,1°K Data sampling 0,1s Measuring range -30...400°C Sensor break and short circuit monitoring are present Sensor voltage ≤ 1mA Calibration accuracy ≤ 0,2% Linearity and indication error ≤ 0,2% +/-1digit Ambient temperature influence on the span ≤ 0,02% / K
Inputs	Switching voltage 24V DC Input current 1mA Suitable for the connection of external, floating contacts
Outputs	24V DC 0,5A 2A max. SMD fuse 4A Short circuit proof, suitable for inductive loads
Relay	1 two-way contact 250V AC 3A cos phi 1